

HATCHERY EVALUATION REPORT

Warm Springs NFH - Spring Chinook

March 1997

Integrated Hatchery Operations Team (IHOT)

HATCHERY EVALUATION REPORT

Warm Springs NFH - Spring Chinook

An Independent Audit Based on Integrated Hatchery Operations Team (IHOT) Performance Measures

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Executive Summary

This report presents the findings of the independent audit of the Warm Springs NFH - Spring Chinook program. The hatchery is located on the north bank of the Warm Springs River, approximately 14 miles north of Warm Springs, Oregon. The hatchery is used for adult collection, incubation, and rearing of spring chinook.

The audit was conducted in 1996-1997 as part of a 2-year effort that will include 67 hatcheries and satellite facilities located on the Columbia and Snake River system in Idaho, Oregon, and Washington. The hatchery operating agencies include the U.S Fish and Wildlife Service, Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, and Washington Department of Fish and Wildlife.

Background

The audit is being conducted as a requirement of the Northwest Power Planning Council (NPPC) Strategy for Salmon and the Columbia River Basin Fish and Wildlife Program. Under the audit, the hatcheries are evaluated against policies and related performance measures developed by the Integrated Hatchery Operations Team (IHOT). IHOT is a multi-agency group established by the NPPC to direct the development of new basinwide standards for managing and operating fish hatcheries. The Bonneville Power Administration (BPA) contracted with Montgomery Watson to act as an independent contractor for the audit.

IHOT has established five basic policies that cover: (1) hatchery coordination, (2) hatchery performance standards, (3) fish health, (4) ecological interaction, and (5) genetics. The audit focuses on all these policies, with the exception of hatchery coordination. These policies are set forth in *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries (IHOT 1995)*. That document is the source for the performance measures that are the basis of this audit.

The Audit Process

The audit was based on the facility management's response to a 109-page questionnaire. This audit form was completed through a five-step process in which:

- Information was obtained from headquarters.
- The hatchery manager was asked to fill out and return the audit form.
- A 1-2 day site audit visit was conducted to inspect facilities, review hatchery records, discuss audit form responses, and develop remedial action plans.
- A compliance report was developed to document the compliance status of each performance measure. This report was then shared with the hatchery manager and IHOT representative.
- This hatchery evaluation report was written to document compliance with IHOT performance measures and develop cost estimates for remedial actions when needed.

Warm Springs NFH - Spring Chinook Results

The Warm Springs facility includes three ponds for adult holding, 40 concrete raceways, 20 starter tanks, and incubation facilities. Warm Spring NFH was authorized in 1966 and began operating in 1978. Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO) entered into an agreement with the U.S. Fish and Wildlife Service to stock the waters of the Water Springs Indian Reservation with salmon and trout to increase fishing opportunities. The goal of the hatchery is to produce spring chinook that will contribute to CTWSRO fisheries while providing adequate escapement for hatchery production.

The Warm Springs NFH - Spring Chinook program was in general compliance with most of the performance measures. In the area of program objectives, the hatchery was not meeting its adult return goal. The audit found that the hatchery was not in compliance with the screen mesh criteria, adult water quality monitoring criteria, temperature criteria, and pathology-free water criteria, which are all facilities requirements. The hatchery needed to construct additional early rearing tanks. The hatchery needed to develop specific incubation and rearing standards and a smoltification monitoring plan. In the compliance area for fish health policy, the hatchery did not provide foot baths in the incubation facility. The hatchery also did not have a Genetics Monitoring and Evaluation Program.

The specific areas in which the Warm Springs NFH - Spring Chinook program requires remedial actions based on the IHOT performance measures are listed below. These remedial actions are listed in alphabetical order without intent of ranking or otherwise assigning priority:

- Activate existing phone dialer system
- Construct at least 10 more starter tanks for early rearing
- Develop approved genetics M&E plan

- Develop smoltification monitoring program
- Develop specific incubation and rearing standards for IHOT Operations Plan
- Install foot baths
- Provide 1/8" mesh for 2 Rex traveling screens
- Provide disinfection for 15,000 gpm
- Provide system to reduce high temperature
- Provide upgraded water supply for rearing
- Run analysis for missing water chemistry parameters, turbidity, alkalinity, hardness, and missing contaminant parameters

Non-compliance issues resulting from items beyond human control or Performance Measures not relevant to this hatchery (Type 1 in Table 3, Section 4 of this report) were not listed above.

Facility Description

Name: Warm Springs National Fish Hatchery

Stock/Species: Spring Chinook

Operating Agency: U.S. Fish and Wildlife Service

Funding Agency: U.S. Fish and Wildlife Service

Location: The hatchery is located on the north bank of the Warm Springs River,
approximately 14 miles north of Warm Springs, Oregon.

Address: P.O. Box 790
Warm Springs, OR 97761

Hatchery Manager: Mr. Mike Paiya

Phone: (541) 553-1692

Fax:

Purpose: Warm Spring NFH was authorized in 1966 and began operating in 1978. Confederated Tribes of the Warm Springs Reservation of Oregon entered into an agreement with the U.S. Fish and Wildlife Service to stock the waters of the Water Springs Indian Reservation with salmon and trout to increase fishing opportunities. The goal of the hatchery is to produce spring chinook that will contribute to CTWSRO fisheries while providing adequate escapement for hatchery production.

Production Goal: Spring Chinook
Produce 750,000 smolts for on-station release

Water Supply:

Water is supplied by pumping from the Warm Springs River. Water use ranges from 9,000 to 18,000 gpm.

Facilities:

Adult Holding:

1 concrete catch pond - 672 cf

2 concrete brood ponds, 4,200 and 4,400 cf

Incubation:

16 full stacks of vertical tray incubators - 256 trays

Early Rearing:

20 starter tanks - 78 cf each

Raceways:

20 BurrowÕs raceways - 2,000 cf each

20 converted BurrowÕs raceways - 1,000 cf each

Rearing Ponds:

None

Satellite Facilities:

None

Compliance Status

The hatchery audits are based on compliance with written IHOT performance measures. These performance measures are documented in *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (referred to as *IHOT 1995* in this report).

The purpose of the performance measures is to implement new basinwide policies that provide regional guidelines for operating anadromous hatcheries in the Columbia Basin.

The audit focuses on performance measures for IHOT policies that cover (1) hatchery performance standards, (2) fish health, (3) ecological interaction, and (4) genetics. These performance measures are intended to guide hatchery operations once production is established. For that reason, the hatchery operations audit included broodstock collection, spawning, incubation of eggs, fish rearing and feeding, fish release, equipment maintenance and operations, and personnel training. Production priorities are beyond the scope of this audit.

Based on *IHOT 1995*, a detailed 109-page audit form was developed. The audit form divided the performance measures into six major sections along major program and technical criteria areas. Two additional sections (sections 1 and 8) include general information and expenditure information needed for this Hatchery Evaluation Report and blank forms for additional comments. The following is the basic structure of the IHOT audit form:

- | | |
|-----------|--|
| Section 1 | Performance Measures for General Information and Expenditure Information (PMs General 1-2) |
| Section 2 | Performance Measures for Program Objectives (PMs 1-4) |
| Section 3 | Performance Measures for Facility Requirements (PMs 5-15) |

Integrated Hatchery Operations Team (IHOT) 1995. *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries*, Bonneville Power Administration, Portland, Oregon.

Section 4	Performance Measures for Hatchery Practices (PMs 16-25)
Section 5	Performance Measures for Fish Health Policy (PMs 26-34)
Section 6	Performance Measures for Ecological Interactions (PMs 35-38)
Section 7	Performance Measures for Genetics Policy (PMs 39-43)
Section 8	Blank Forms for Additional Comments.

Several performance measures are repeated in various sections of the audit form. These performance measures overlap in *IHOT 1995* and were retained to allow individuals interested in specific portions of the audit (such as Genetics or Fish Health) to determine the compliance status of all performance measures for a given topic in one location. A repeated performance measure is indicated by shaded text.

The Hatchery Audit Process

The hatchery audit will be conducted over a 2-year period that concludes in 1997. At each hatchery, a five-step process was used to complete the overall hatchery audit. This process consisted of research and onsite visits. The site visit at the Warm Springs NFH was conducted on March 14, 1997.

The following is the five-step audit process:

1. Information was obtained from headquarters.
2. The hatchery manager was asked to fill out and return the **Audit Form**.
3. A 1-2 day site audit visit was conducted at each hatchery. During that visit an audit team inspected facilities, reviewed hatchery records, discussed audit form responses, and developed remedial action plans when appropriate.

4. During the site visit, the compliance status of each performance measure was discussed with the hatchery manager and IHOT representative. A portion of the Hatchery Evaluation Report was sent to the hatchery manager following the audit visit as a **Compliance Report**. That Compliance Report is Table 2 of this report.
5. Information from steps 1-4 was used to prepare a draft **Hatchery Evaluation Report**. This draft report was submitted to the operating agencies for review of the information used to determine compliance. Based on review and comments, a final Hatchery Evaluation Report was developed. The final report documents the compliance of a particular hatchery with the IHOT performance measures and presents cost estimates to correct any deficiencies.

Compliance Status of Warm Springs NFH - Spring Chinook

The following table includes information on life-stages that are held on this facility for some portion of their rearing cycle (Table 1). For multi-facility programs, summary cost and contribution data is presented at the facility where rearing occurs. For the compliance status relating to performance measures that do not occur at this hatchery, please refer to the Hatchery Evaluation Reports for the hatcheries and stocks listed in Table 1. A check mark (✓) indicates that the specific life-stage is held at this facility.

This section documents the compliance status of the Warm Springs NFH - Spring Chinook program. Each performance measure is presented in a table taken from the audit form (Table 2). The compliance status is identified by the following categories:

- **N/A** (not applicable)
- **Yes** (in compliance)
- **?** (unknown; generally due to unavailability of information to determine compliance)
- **No** (not in compliance).

Remedial actions are suggested for performance measures not in compliance. These remedial actions are grouped into categories and listed in Section 4 of this report, where the cost of the required remedial actions is also presented.

Table 1 Summary Program Information for Warm Springs NFH - Spring Chinook

Component	Location of Adult Holding, Spawning, Incubation, and Rearing					
	Warm Springs NFH					
Adult Collection	4					
Adult Holding	4					
Spawning	4					
Fertilization	4					
Incubation	4					
green-to-eyed	4					
eyed-to-hatch	4					
Rearing	4					
fry	4					
fingerlings	4					
smolts	4					
Acclimation/release	4					

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#1	Are the hatchery programs outlined in a subbasin management plan?		4			Columbia Basin System Planning Production Plan and Deschutes subbasin plan	
#2	Is the hatchery operating under a current hatchery operational plan? Is it understood by staff? Is it being followed?		4 4 4			IHOT Operations Plan and Warm Springs Hatchery Operations Plan	
#3	Is a hatchery monitoring and evaluation plan in place? Do you have a written monitoring and evaluation plan?		4			CWT and Missing Production Groups Reports; Hatchery Evaluation Vision Action Plan	
#4a	Adult contribution to fisheries, spawning grounds, and hatchery		4			Review of records	
#4b	Adult pre-spawning survival as compared with established goal		4			Review of records; in compliance 3 out of last 3 years	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
#4c	Egg-take as compared with established hatchery goal				4	Review of records; in compliance 3 out of last 5 years	Improve adult returns
#4d	Green-egg to eyed-egg survival as compared with established goal		4			Review of records; in compliance 5 out of last 5 years	
#4e	Eyed-egg to fry survival as compared with established goal		4			Review of records; in compliance 5 out of last 5 years	
#4f	Fry to smolt survival as compared with established goal		4			Review of records; in compliance 4 out of last 4 years	
#4g	Production as compared with established goal				4	Review of records; in compliance 3 out of last 5 years	Improve adult returns
#4h	Percent survival (smolt to adult) as compared with established goal				4	Review of records; in compliance 0 out of last 3 years	Improve adult returns
#4i	Number of eggs, fry, fingerlings, smolts, and/or adults to meet basinwide needs	4				Review of records/Discussion	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#5a	Temperature						
	Does your water temperature meet the criteria for spawning?		4			Review of records/Discussion	
	Does your water temperature meet the criteria for incubation?		4			Review of records/Discussion	
	Does your water temperature meet the criteria for rearing?				4	High temperatures in summer cause problems	Provide system to reduce high temperature
#5b	Dissolved gases						
	Is the oxygen level near saturation?		4			Review of records/Discussion	
	Is the dissolved nitrogen level less than saturation?		4			Review of records/Discussion	
#5c	Chemistry						
	Ammonia (un-ionized)		4			Review of records/Discussion	
	Carbon Dioxide			4		No data	Run analysis
	Chlorine			4		No data	Run analysis
	pH		4			Review of records/Discussion	
	Copper		4			Review of records/Discussion	
	Hydrogen Sulfide			4		No data	Run analysis
	Iron		4			Review of records/Discussion	
	Zinc		4			Review of records/Discussion	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
#5d	Turbidity						
	Does your turbidity meet the criteria?			4		No data	Run analysis

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#5e	Alkalinity and hardness Does your alkalinity and hardness meet the criteria?			4		No data	Run analysis
#5f	Nitrite Does your nitrite meet the criteria?			4		No data	Run analysis
#5g	Contaminants Aldrin Endrin Dieldrin Heptachlor Chlordane Methoxychlor Lindane Malathion Guthion		4 4 4 4 4 4 4	4 4		Review of records/Discussion Review of records/Discussion Review of records/Discussion Review of records/Discussion Review of records/Discussion Review of records/Discussion Review of records/Discussion No data No data	Run analysis Run analysis
#5h	Pathogens What portions of the hatchery have disease-free water? Adult holding Incubation Early rearing				4 4 4	Inspection of facilities/Discussion Inspection of facilities/Discussion Inspection of facilities/Discussion	Provide disinfection for 15,000 gpm See above See above

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
	Rearing				4	Inspection of facilities/Discussion	See above
	Others				4	Inspection of facilities/Discussion	See above

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#6	Alarm Systems						
	Do the following areas have alarms?						
	Intake		4			Inspection of facilities/Discussion	
	Large rearing ponds and adult holding ponds		4			Inspection of facilities/Discussion	
	Raceway headboxes and rearing ponds		4			Inspection of facilities/Discussion	
	Incubation facilities		4			Inspection of facilities/Discussion	
	Quarantine areas and facilities		4			Inspection of facilities/Discussion	
	Water treatment systems		4			Inspection of facilities/Discussion	
	Security		4			Inspection of facilities/Discussion	
	Are there outside systems and buzzers in onsite residences?		4			Discussion	
#6	Are water flow alarms checked daily?		4			Review of records/Discussion	
	Are all other alarms checked weekly?		4			Discussion	
	Is there a log of alarms for emergencies, tests, and maintenance requirements?		4			Review of records/Discussion	
	Are telephone pagers used?				4	Discussion	Activate existing phone dialer system

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
#7	Adult collection and holding facilities						
	Do you meet the adult holding criteria?		4			Review of records/Discussion	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#8	Incubation facilities						
	Type 1: <u>Colanders/Tanks (20)</u> Do you have an adequate number of units for the overall program?		4			Inspection of facilities/Discussion	
#9	Type 2: <u>Vertical tray</u> Do you have an adequate number of units for the overall program?		4			Inspection of facilities/Discussion	
	Rearing facilities						
	Type 1: <u>Raceways</u> Do you have an adequate number of units for the overall program?		4			Inspection of facilities/Discussion	
	Type 2: <u>Tanks (20)</u> Do you have an adequate number of units for the overall program?				4	Inspection of facilities/Discussion	Need at least 10 more tanks to meet early rearing requirements
	Type 3: _____ Do you have an adequate number of units for the overall program?	4				Inspection of facilities/Discussion	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
#10	Screening facilities						
	Do you meet the approach velocity criteria?		4			Inspection of facilities/Discussion	
	Are the fish screens regularly cleaned?		4			Inspection of facilities/Discussion	
	Does the screen mesh meet screen opening criteria?				4	Inspection of facilities/Discussion	Provide 1/8" mesh for 2 Rex traveling screens
	Are rearing containers double screened for fish that should not be released to adjacent water?	4				Inspection of facilities/Discussion	
#11	Predator control facilities						
	Are your predation control facilities effective?		4			Inspection of facilities/Discussion Otters a continuing problem	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#12	Food storage facilities and quality control						
	Does the storage of dry/semi-moist/moist foods (dry<12%; semi-moist 12-20%; moist >20% moisture) follow food manufacturer's recommendations?		4			Inspection of facilities/Discussion	
	Does a regional quality control officer oversee production procedures and monitor:						
	Verification by feed manufacturer that ingredients meet specifications?		4			Discussion	
	Ensure feed does not contain unwanted drugs or other additives?		4			Discussion	
	Analyze ingredients contained in the final food product to ensure that feed specifications have been met?		4			Discussion	
	Are the foods stored and handled according to the following criteria?						

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
	Moist pellets should not exceed 10°F at point of delivery.		4			Discussion	
	Moist pellets should be removed from freezer just prior to feeding.		4			Discussion	
	Do not leave buckets of feed or feed containers outside exposed to light or heat.		4			Discussion	
	Open bags of feed should be fed within 1 to 2 days except when feeding small groups of fish.		4			Discussion	
	Automatic feeder hoppers and bulk storage facilities should be insulated against excessive temperatures (80°F and above).	4				None	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#13	Release facilities Do the release facilities ensure that fish are not subjected to adverse conditions?		4			Inspection of facilities/Discussion	
#14	Pollution abatement facilities Do the pollution abatement facilities meet all federal and state regulations (or good engineering practice)? Are pollution abatement facilities operated correctly?		4 4			Inspection of facilities/Discussion Discussion	
#15	Transportation facilities Are the transport systems adequate to meet IHOT performance measures for transportation practices?	4				Released on station	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#16	Broodstock selection practices						
	Is the donor selection process document attached? (PM #40a)	4				Existing program; does not apply	
	Was the donor selection outline followed in selecting the hatchery broodstock? (PM #40b-c)	4				Existing program; does not apply	
#17	Spawning practices						
	Were the appropriate number of spawners, male/female ratios, and fertilization protocols used? (PM #42c-g)		4			Review of records/Discussion	
#18	Incubation practices						
	Are specific incubation standards listed in the hatchery operations plan?				4	Reviewed IHOT Operations Plan	Develop specific incubation standards for the IHOT Operations Plan
	Are incubation practices written?				4	See above	See above
	Incubation Type 1: <u>Tanks</u> (see PM #8)			4		No criteria	See above
	Do you meet the loading and flow criteria?						

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
	Incubation Type 2: <u>Vertical tray</u> (see PM #8) Do you meet the loading and flow criteria?		4			Review of records/Discussion	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#19	Rearing practices						
	Are specific rearing standards listed in the hatchery operations plan?				4	Review IHOT Hatchery Operations Plan and	Develop specific rearing standards for the IHOT Operations Plan
	Are rearing practices written?				4	See above	See above
	Rearing Unit Type 1: <u>Raceways</u> (see PM #9)						
	Do you meet the density and DI criteria?		4			Review of records/Discussion	
	Do you meet the Loading and FI criteria?		4			Review of records/Discussion	
	Rearing Unit Type 2: <u>Tanks</u> (see PM #9)						
	Do you meet the density and DI criteria?				4	Review of records/Discussion	Provide at least 10 additional starter tanks
	Do you meet the Loading and FI criteria?				4	Review of records/Discussion	See above
	Rearing Unit Type 3: _____ (see PM #9)						
#20	Smolt quality						
	Do you produce a high quality smolt?				4	Discussion	Provide upgraded water supply for rearing

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#21	Fish health management practices						
	Are the monthly hatchery monitoring visits being conducted? (PM #26)		4			Review of records/Discussion	
	Are the annual broodstock inspections being conducted? (PM #27)		4			Review of records/Discussion	
	Is there pathogen-free water (PM #5h)and are the sanitation procedures being followed? (PM #28)				4	Review of records/Discussion	See PM #5h
	Are the following water quality parameters within criteria? (PM #5a-5g)						
	Water temperature				4	Review of records/Discussion	See PM #5a
	Dissolved gases		4			Review of records/Discussion	
	Chemistry			4		No data	See PM #5c
	Turbidity			4		See above	See PM #5d
	Alkalinity and hardness			4		See above	See PM #5e
	Nitrite			4		See above	See PM #5f
	Contaminants			4		See above	See PM #5g
	Are rearing standards being followed? (PM #19)				4	Review of records/Discussion	See PM #19

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
	Are egg and fish transfer/release requirements met? (PM #31)		4			Review of records/Discussion	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#22a	Does hatchery performance meet requirements outlined in the regional hatchery policies and in subbasin and hatchery plans for the following areas?						
#22a1	Percent smoltification Do you measure percent smoltification? Do you have a smoltification goal Did you meet the smoltification criteria?		4	4	4	Discussion Discussion Discussion	Develop smoltification monitoring program
#22a2	Rearing density (prior to release) Did you meet the rearing density criteria just prior to release?		4			Review of records/Discussion	
#22a3	Disease condition (at release) Did you meet all disease regulations just prior to release?		4			Review of records/Discussion	
#22a4	Number (at release) Did you meet the release number goal?				4	Review of records/Discussion	Improve adult returns
#22a5	Size at release Did you meet the size goal?		4			Review of records/Discussion	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
#22a6	Dates of release						
	Did you meet the release date goal?		4			Review of records/Discussion	
#22a7	Location of release						
	Did you release the fish at the specified location?		4			Review of records/Discussion	
#22b	Are fish reared in the subbasin or acclimated in the subbasin?						
	Are the fish reared in the subbasin?		4			Discussion	
	Are the fish acclimated in the subbasin?		4			Discussion	
#22c	Is the release strategy appropriate for the program?		4			Discussion	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#23	Transportation facilities						
	Do transportation equipment and personnel receive disinfection before and after use?	4				No transportation	
	Is the fish tank interior disinfected using a solution of 200 ppm active chlorine for 30 minutes minimum or formaldehyde gas generation method (relative humidity of 60% for 2 hrs)?	4				See above	
	Is the exterior of the fish transport vehicle disinfected using high pressure steam (115-130°C), high temperature acid, or with 200 ppm chlorine for 30 minutes?	4				See above	
	Is the fish transport vehicle (cab) disinfected using 600 ppm quaternary ammonia compounds (1.5 ml of 50% stock solution/liter water)?	4				See above	
	Is other equipment disinfected including fish pumps, nets, egg sorters, waders, boots, rain gear, hoses and other equipment using one of the following solutions?	4				See above	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
	200 ppm chlorine for 30 minutes 600 ppm quaternary ammonia compound for 30 minutes 200 ppm iodophor solution for 10 minutes						
	Do personnel wear protective garments when handling fish eggs or cultural water?	4				See above	
	Do the fish transport truck/chassis and tank/unit receive an inspection and service prior to the release season?	4				See above	
	Is a daily service inspection completed before starting up and leaving for the day?	4				See above	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#23 (cont)	Transportation facilities						
	Does the fish transport unit receive an inspection prior to loading?	4				No transportation	
	Does a pre-loading inspection covering tank water level, pumps or aerators, oxygen injection system settings, displacement gauge, and truck loading/hauling density tables checked and reviewed occur prior to loading fish in the transport unit?	4				See above	
	Do hauling criteria include checking the fish 45 minutes to 1 hour after loading?	4				See above	
	When fish are active and systems are functioning properly, is the oxygen concentration reduced and maintained at approximately 8 ppm?	4				See above	
	Is water temperature in the transportation unit maintained within the 42-48 °F range?	4				See above	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
	Do fish releasing procedures include the following criteria?					See above	
	Releasing the fish at the correct release site or into the correct water body.	4				See above	
	Tempering or the difference between the liberation tank and the target water body should not exceed 10°F.	4				See above	
	The liberation hose should be angled so that fish gently hit the water. Using a tripod is a method of ensuring the hose will stay at the proper angle.	4				See above	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#24	Evaluation practices						
	Has the hatchery conducted fishery contribution studies to:						
	Determine the requirements for evaluating and improving management programs?		4			Discussion	
	Develop guidelines that define the geographical area and identify component stocks (hatchery and/or wild) that comprise the management unit?		4			Discussion	
	Develop guidelines that define if the proper stocks of fish are currently being used?		4			Discussion	
	Determine which management units contribute to a specific fishery and the time periods of those contributions?		4			Discussion	
	Determine the relative contributions of the various management units to a specific fishery over the different time periods?		4			Discussion	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#25	Training practices						
	Does the hatchery have a training schedule for its staff?		4			Review of records/Discussion	
	Does each staff member have a personal training plan approved by a supervisor and reviewed annually?		4			Review of records/Discussion	
	Does the hatchery routinely exchange training details between other hatcheries and agencies?		4			Review of records/Discussion	
	Does the hatchery encourage and reward off-duty training of staff?		4			Review of records/Discussion	
	Does the hatchery conduct monthly staff meetings?		4			Review of records/Discussion	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#26	Are monthly hatchery monitoring visits being conducted by a qualified fish health specialist as described below?						
	Conduct visit at least monthly		4			Review of records/Discussion	
	Monitoring conducted by qualified fish health specialist		4			Review of records/Discussion	
	Examine a representative sample of healthy and moribund fish from each lot.		4			Review of records/Discussion	
	Review fish culture practices with hatchery manager.		4			Review of records/Discussion	
	Report finding and results of necropsies on standard form.		4			Review of records/Discussion	
	Recommend appropriate drug or chemical treatment.		4			Review of records/Discussion	
	Summarize fish health status or stock prior to release or transfer to another facility.		4			Review of records/Discussion	
#27	Are all of the functions of the hatchery yearly monitoring visits being completed as described below?						

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
	Annually examine each broodstock for the presence of reportable viral pathogens.		4			Review of records/Discussion	
	Annually screen each salmon broodstock for the presence of <i>Renibacterium salmoninarum</i> .		4			Review of records/Discussion	
	Conduct inspection by or under the supervision of qualified fish health specialist.		4			Review of records/Discussion	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#28	Is the hatchery following accepted sanitation procedures?						
	Are there any sources of pathogen-free water, especially for incubation and early rearing?				4	Filtration + UV; but not 100% effective	Provide pathogen-free water for 15,000 gpm
	Are the hatchery sanitation procedures understood and being followed as described below?						
	Disinfect/water harden eggs in iodophor?		4			Inspection of facilities/Discussion	
	Are foot baths containing disinfectant placed at the incubation facility's entrance and exit?				4	Inspection of facilities/Discussion	Install foot baths
	Is equipment and rain gear utilized in broodstock handling or spawning sanitized prior to its use elsewhere in the hatchery?		4			Inspection of facilities/Discussion	
	Is equipment used to collect dead fish sanitized prior its use in another pond and/or lot of fish?		4			Inspection of facilities/Discussion	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
	Is equipment, including vehicles used to transfer fish between facilities, disinfected prior to use with any other fish lots or at any other location?		4			Inspection of facilities/Discussion	
	Are rearing vessels sanitized after fish are removed and prior to introducing a new fish lot or stock?		4			Inspection of facilities/Discussion	
	Are dead fish properly disposed of?		4			Inspection of facilities/Discussion	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#29	Are water quality parameters being followed?						
	Are the following water quality parameters within criteria? (PM #5a-5g)						
	Water temperature		4		4	Review of records/Discussion	See PM #5a
	Dissolved gases					Review of records/Discussion	
	Chemistry			4		Review of records/Discussion	See PM #5c
	Turbidity			4		Review of records/Discussion	See PM #5d
	Alkalinity and hardness			4		Review of records/Discussion	See PM #5e
	Nitrite			4		Review of records/Discussion	See PM #5f
	Contaminants			4		Review of records/Discussion	See PM #5g
	Go to PM #21						
#30	Are incubation and rearing standards being followed?						
	Are the incubation practices following the IHOT incubation criteria? (PM #18)			4		Review of records/Discussion	See PM #18
	Are the rearing practices following the IHOT criteria? (PM #19)		4			Review of records/Discussion	
	Go to rearing practices PM #18-PM #19						
#31	Are egg and fish transfer/release requirements met?		4			Discussion	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#32	Is the hatchery's program outlined in a subbasin management plan? Go to subbasin plan PM #1		4			Columbia Basin System Planning Production Plan and Deschutes subbasin plan	
#33	Is the hatchery operating under a current hatchery operational plan? Go to operational plan PM #2		4			Review IHOT Operations Plan and Warm Springs Hatchery O&M Manual	
#34	Is a hatchery monitoring and evaluation plan in place? Go to hatchery monitoring and evaluation plan PM #3		4			CWT and Missing Production Group Reports Hatchery Evaluation Vision Action Plan	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#35	Does the hatchery program meet requirements established in the regional hatchery policies and subbasin planning documents in the following areas: species, stock, broodstock collection location, broodstock numbers, broodstock collection strategy, and spawning and egg-take protocols?						
	Does the hatchery program meet the requirements for the following?						
	Species protocols (PM #1)		4			Review of records/Discussion	
	Stock protocols (PM #1)		4			Review of records/Discussion	
	Broodstock collection location protocols (PM #41b for existing program; PM #39b for new program)		4			Review of records/Discussion	
	Broodstock numbers protocols (PM #42c)		4			Review of records/Discussion	
	Broodstock collection strategy protocols (PM #41b-d for existing program; PM 39b-f for new program)		4			Review of records/Discussion	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
	Spawning protocols (PM #42d-e)		4			Review of records/Discussion	
	Egg-take protocols (PM #42f-g)		4			Review of records/Discussion	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#36	Does the hatchery's performance meet requirements outlined in the regional hatchery policies and in subbasin and hatchery plans for the following areas: percent smoltification, rearing density, disease condition, and the number, size date(s), and location of release?						
	Percent smoltification (PM #22a1)			4		Review of records/Discussion	See PM #22a1
	Rearing density (PM #22a2)		4			Review of records/Discussion	
	Disease condition (PM #22a3)		4			Review of records/Discussion	
	Number at release (PM #22a4)				4	Review of records/Discussion	See PM #22a4
	Size at release (PM #22a5)		4			Review of records/Discussion	
	Date of release (PM #22a6)		4			Review of records/Discussion	
	Location of release (PM #22a7)		4			Review of records/Discussion	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
#37	Are fish reared in the subbasin or acclimated in the subbasin? See PM #22b		4			Discussion	
#38	Is the release strategy appropriate for the program? See PM #22c		4			Discussion	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#39	For new programs, has a broodstock collection plan been developed?						
#39a	Is the broodstock collection plan written?	4				Existing Program; does not apply	
	For a non-captive broodstock program:	4				Existing Program; does not apply	
#39b	Was an unbiased, representative sample collected?						
#39c	Was the recommended number of broodstock collected?	4				Existing Program; does not apply	
	For a captive broodstock program:						
#39d	Were captive brood progeny excluded as donors for propagating the next generation of the captive broodstock program?	4				Existing Program; does not apply	
#39e	Were full-sib crosses avoided?	4				Existing Program; does not apply	
#39f	Is the broodstock collection plan understood and being followed by staff?	4				Existing Program; does not apply	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
#40	For a new program, was the donor selection outline followed in selecting the hatchery broodstock?						
#40a	Is a donor selection plan written?	4				Existing Program; does not apply	
#40b	Was the donor selection outline followed in selecting the broodstock?	4				Existing Program; does not apply	
#40c	Was the target stock recommended in the donor selection process actually used?	4				Existing Program; does not apply	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#41	For existing programs, were the broodstock collection procedures followed?						
#41a	Is the broodstock collection plan written?		4			Review Hatchery 5-year plan	
	Does the broodstock collection plan follow the guideline:						
#41b	Was an unbiased, representative sample collected?		4			Discussion	
#41c	Was the recommended number of broodstock collected?		4			Discussion	
#41d	Were the broodstock collection procedures in hatchery operation plan understood and followed?		4			Discussion	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#42	Was the appropriate number of spawners, male/female ratios, and fertilization protocols used?						
#42a	Are the spawning protocols written?		4			IHOT Operations Plan	
#42b	Are daily or weekly spawning logs available?		4			Review of records	
#42c	Was the appropriate number of spawners used?		4			Discussion	
#42d	Did you attempt to spawn all collected broodstock and randomize mating with respect to age class, and other traits?		4			Discussion; Goal is to also spawn 2-5% of jacks collected	
#42e	Was the sex-ratio within the limits given in the performance standards?		4			Discussion	
#42f	Were the fertilization protocols followed?		4			Discussion	
#42g	If the hatchery needed to reduce the number of eggs retained, was this done by representative sampling of each male/female cross?		4			Discussion	

Table 2 Warm Springs NFH - Spring Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#43	Is there a genetics monitoring and evaluation program in place?						
	Is a genetics monitoring and evaluation program available?				4	None provided	Develop approved genetics M&E Plan
	Does the plan address the following elements listed in IHOT:						
	Does the program have elements needed to meet evaluation goals 1-4?				4	See above	See above
	Has a qualified geneticist reviewed and endorsed the program (goal 5)?				4	See above	See above
	Will the program collect the data and maintain the records needed to evaluate compliance on an ongoing basis (goal 5)?				4	See above	See above
	Is the program understood and followed by staff?				4	See above	See above

Remedial Actions

Based on the compliance status for each performance measure, remedial actions were developed. The required remedial actions are organized into five categories. The types of categories range across a spectrum from those actions that are beyond human control, to those that require a change in agency policy or procedures, to those that involve a significant capital cost to put in place. The following are the five types of remedial actions identified under phase 1 of the audit:

The Five Types of Remedial Actions

Type	Description
1	Non-compliance issues resulting from items beyond human control or Performance Measures not relevant for this hatchery
2	Remedial actions requiring changes in agency policies or procedures
3	Remedial actions requiring changes in monitoring coverage or interval
4	Remedial actions requiring significant capital expenditures
5	Remedial actions that may require significant capital expenditures but are not clearly definable at this time

Remedial Actions at Warm Springs NFH - Spring Chinook

This section presents the corrective actions required to bring the Warm Springs NFH - Spring Chinook program into compliance with IHOT performance measures. The remedial actions suggested here are just that, suggestions developed by the Montgomery Watson Audit Team. For some non-compliance areas, other remedial actions could be proposed. The required remedial actions are cross-referenced to each IHOT performance measure that was not in compliance. Where appropriate, the costs associated with the remedial actions are also presented (Table 3).

The cost estimates presented in this section are based on professional experience from similar projects. In most cases, only a lump-sum figure is presented, and detailed take-off lists have not been prepared. The cost estimates are essentially order of magnitude estimates ($\pm 40\%$).

More importantly, the suggested remedial activities may also present several levels of action. Optional actions have been listed for several problems. These optional actions are desirable for either operational or safety considerations.

Table 3. Remedial Actions Required at Warm Springs NFH - Spring Chinook

Remedial Action Required	Cost	PMS ¹
Type 1 - Non-compliance issues resulting from items beyond human control or Performance Measures not relevant for this hatchery Improve adult returns	----	4c, 4g, 4h, 22a4
Type 2 - Remedial actions requiring changes in agency policies or procedures Develop specific incubation and rearing standards for IHOT Operations Plan Develop smoltification monitoring program Install foot baths Develop approved genetics M&E plan	---- ---- ---- ----	18-19 22a1 28 43
Type 3 - Remedial actions requiring changes in monitoring coverage or interval Run analysis for missing water chemistry parameters, turbidity, alkalinity, hardness, and missing contaminant parameters	----	5c-5g
Type 4 - Remedial actions requiring significant capital expenditures Activate existing phone dialer system Construct at least 10 more starter tanks for early rearing Provide 1/8" mesh for 2 Rex traveling screens	500 \$50,000 \$10,000	6 9, 19 10
Type 5 - Remedial actions that may require significant capital expenditures but are not clearly definable at this time Provide system to reduce high temperature Provide disinfection for 15,000 gpm Provide upgraded water supply for rearing	---- ---- ----	5a 5h, 28 20

Hatchery Contribution to Fisheries, Spawning Grounds, and Hatcheries

This section presents the audit findings for the Warm Springs NFH - Spring Chinook program contribution of adult fish to fisheries, local fisheries, spawning grounds, and hatcheries. Data is reported by broodyear. A broodyear refers to the adult contribution from the eggs produced from a single group of spawning adults. For some species, this may include fish caught as 2-, 3-, 4-, 5-, and 6-year old fish. Because of the return distribution and data processing delays, the complete adult contribution for a given broodyear may not be available until 4 to 5 years after the fish have been released from the hatchery.

**Table 4. Adult Contribution to Fisheries, Spawning Grounds, and Hatcheries:
Warm Springs NFH - Spring Chinook**

Year	Fisheries	Spawning Grounds¹	Hatchery¹	Total Combined Contribution	Smolt to Adult Survival (percent)
	(Broodyear)	(Broodyear)	(Broodyear)	(Broodyear)	

Data obtained from Missing Production Groups Annual Report or from the Regional Mark Information System database.

Total combined adult contribution; presented when it is not possible to subdivide the contribution into fisheries, spawning grounds, and hatchery contributions.

1981					
1982					
1983					
1984					
1985					
1986					
1987	374	?	552	926	0.14
1988	490	?	851	1341	0.18
1989	80	?	141	221	0.021
1990					
1991					

Annual Operating Expenditures

The level and detail of annual operating expenditures varies widely depending on hatchery, operating agency, and funding source. When provided, expenditures were presented in terms of personnel costs, operating costs (power, feed, supplies), capital costs, indirect costs charged to the federal government, third-party costs, and other costs. These cost components were summed to determine a total hatchery annual cost. Based on discussion with the hatchery manager, the percent of total hatchery costs allocated to a given program was estimated. The total hatchery costs and the percent of hatchery costs allocated to a given program were used to compute the cost of a given program. Table 5 shows the annual operating expenses for the Warm Springs NFH - Spring Chinook program. For programs that occur at more than one facility (as shown on Table 1 in Section 3 of this report), the cost breakdown for the component(s) at each facility is presented in separate tables (Table 5a).

Table 5. Annual Operating Expenses: Warm Springs NFH - Spring Chinook

Hatchery	1994	1995	1996
1. Warm Springs NFH	\$459,840	\$450,024	\$541,863
2.			
3.			
4.			
5.			
Total Program Costs	\$459,840	\$450,024	\$541,863

The total expenditures for the Warm Springs NFH are presented in Table 6 by program. The detailed breakdown of program expenditures at this hatchery are presented in separate tables (Table 6a).

Table 6. Annual Operating Expenses - Warm Springs NFH

Program	1994	1995	1996
1. Spring Chinook	\$459,840	\$450,024	\$541,863
2.			
3.			
4.			
5.			
Total Hatchery Costs	\$459,840	\$450,024	\$541,863

Table 5a. Annual Operating Expenses: Warm Springs NFH - Spring Chinook

Expenditure Occurring at Warm Springs NFH

Component	1994	1995	1996
Personnel Costs	\$250,512	\$242,468	\$275,792
Operational Costs	\$209,328	\$207,556	\$266,071
Capital Costs			
Indirect Costs			
Lumped Hatchery Costs			
Lumped Third-Party Costs			
Total Hatchery Costs	\$459,840	\$450,024	\$541,863
Source of Funds			
U.S. Fish & Wildlife Service	100%	100%	100%
Program Production (lb)			
Total Production (lb)			
Program as Percent of Total	100%	100%	100%
Program Costs	\$459,840	\$450,024	\$541,863

When it was not possible to obtain a detailed cost breakdown from an agency or third party, the undivided costs were entered here.

Table 6a. Detailed Expenditures at Warm Springs NFH by Program

Spring Chinook

Component	1994	1995	1996
Personnel Costs	\$250,512	\$242,468	\$275,792
Operational Costs	\$209,328	\$207,556	\$266,071
Capital Costs			
Indirect Costs			
Lumped Hatchery Costs			
Lumped Third-Party Costs			
Total Hatchery Costs	\$459,840	\$450,024	\$541,863
Source of Funds			
U.S. Fish & Wildlife Service	100%	100%	100%
Program Production (lb)			
Total Production (lb)			
Program as Percent of Total	100%	100%	100%
Program Costs	\$459,840	\$450,024	\$541,863

PMs are performance measures that were extracted from the IHOT 1995 report. The IHOT

When it was not possible to obtain a detailed cost breakdown from an agency or third party, the undivided costs were entered here.

performance measures are listed in Table 2 (Section 3 of this report) in numerical order.